Tasmanian Devil

Program Plan

25 August 1999

Background

- **DMSO, the technology transition agency for M&S in DoD, developed the High Level Architecture (HLA) and supporting tools, software and processes to support the broad DoD M&S community**
- **The Air Force is interested to use the HLA to meet its future distributed mission training requirements**
- **The Air Force and the Navy are interested in how the HLA can help support joint training**
- **Tasmanian Devil is a research project aimed at gaining practical experience in the application of the HLA in the distributed mission training domain**
  - **to provide feedback to the participating service organizations, the DMSO technology programs, and the larger M&S community.**

What is the High Level Architecture?

- **The High Level Architecture is comprised of three elements:**
  - **Interface Specification**
  - **Object Model Template (OMT) Specification**
  - **HLA Rules for Federates and Federations**
- **These three elements commonly applicable across all DoD simulations, provide a common framework within which specific system architectures can be defined.**

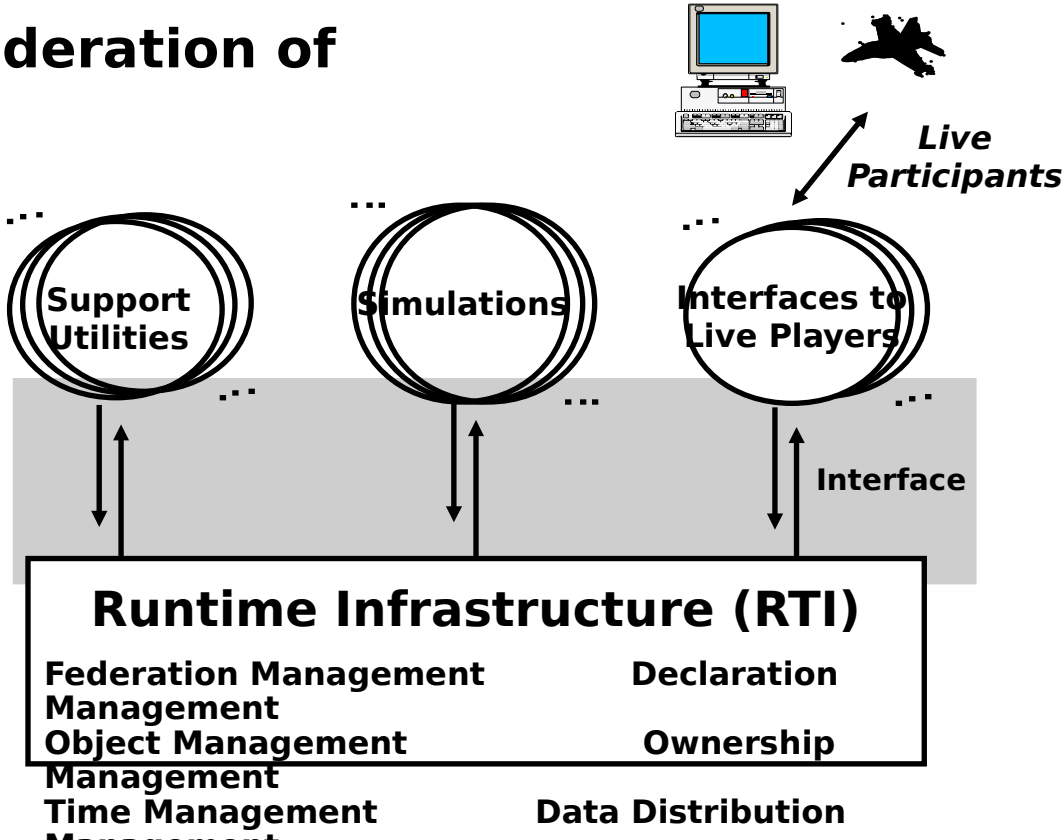
DoD Policy:

“ Under the authority of [DoD Directive 5000.59], and as prescribed by [the DoD Modeling and Simulation Master Plan], I designate the High Level Architecture as the standard technical architecture for all DoD simulations.”

Dr. Paul Kaminski
10 September 1996

The High Level Architecture (HLA)

- Architecture calls for a federation of simulations
- Architecture specifies
  - Ten Rules which define relationships among federation components
  - An Object Model Template which specifies the form in which simulation elements are described
  - An Interface Specification which describes the way simulations interact during operation



The HLA is not the RTI; the HLA says there will be an RTI that meets A requirements but it doesn't specify a particular software implementat

Why HLA Now?

- **DoD M&S Vision**
  - **“ ...common use of these environments will promote a closer interaction between the operations and acquisition communities in carrying out their respective responsibilities. To allow maximum utility and flexibility, these modeling and simulation environments will be constructed from affordable, reusable components interoperating through an open systems architecture.”**
  - **DoD embarking on development of new generation of simulations**
- **Current technology does not provide tools necessary to achieve DoD M&S Vision (i.e., ALSP and DIS)**

DoD Executive Council on Modeling and Simulation (EXCIMS), March 13, 1992

Tasmanian Devil Project Objectives

- **Demonstrate use of HLA in a high fidelity, warfighter-in-the-loop air-to-air training environment**
  - **Provide feedback to DMSO on HLA and associated tools, concepts and processes.**
  - **Demonstrate VxWorks –based federate operating with federates using other operating systems and RTI ports**
  - **Gain HLA certification for the participating federates**
  - **Beta test new industry-developed and DMSO-sponsored HLA infrastructure software (RTI NG)**

Tasmanian Devil Project Objectives

- Demonstrate use of same Federation Object Model (FOM) in two federations with two different mixes of federates
- Develop a FEDEP checklist for training federations
- Address issues of evolutionary persistent federations
- Use and assess agile FOM approach
- Address issues associated with operating in a classified environment
- Develop follow-on plans

Definition: Persistent Federations

- **A persistent federation is a macro-collection of specific federates and a Federation Object Model (FOM).**
  - **Different subsets of the federation may be executed many times over an extended period of time.**
  - **The composition of any federation subset, in terms of the participating types and numbers of federates, the FOM or subset of the FOM used in the execution, and each federate's participation in the FOM, may vary from execution to execution.**
  - **However, the composition of a particular execution is always a subset of the overall persistent federation.**

Definition: Evolutionary Federation

- **A persistent federation that evolves its composition over time. The evolution must be systematically managed to ensure that the entire federation evolves at the same pace and to ensure that design decisions made early in the life of the federation do not adversely impact overall federation evolution.**

Definition: FOM Agility

- **The ability of a federate with a given Simulation Object Model (SOM) to easily map the SOM to different Federation Object Models**

In layman's terms: FOM agility is a characteristic of a simulation's interface to other simulations that allows the simulation to easily, quickly, and cheaply be used in many different applications

  - **one set of units to another (e.g., nm to km)**
  - **one transformation to another (e.g., one coordinate transformation to another)**
- **the SOM superset to the required FOM subset (e.g., point and pick desired object and interaction classes)**

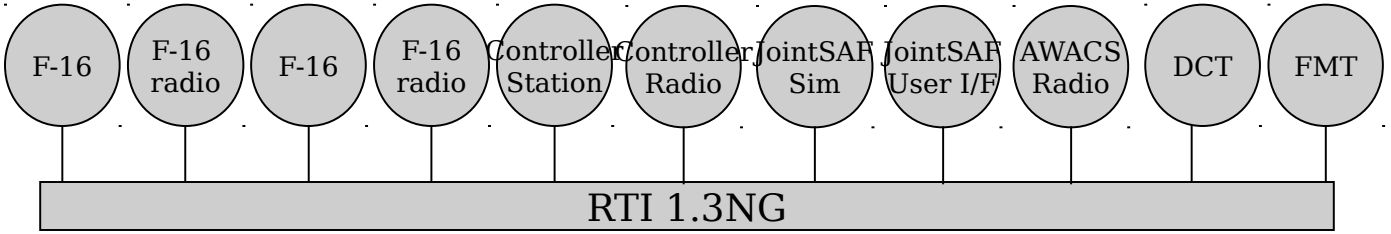
Research Approach

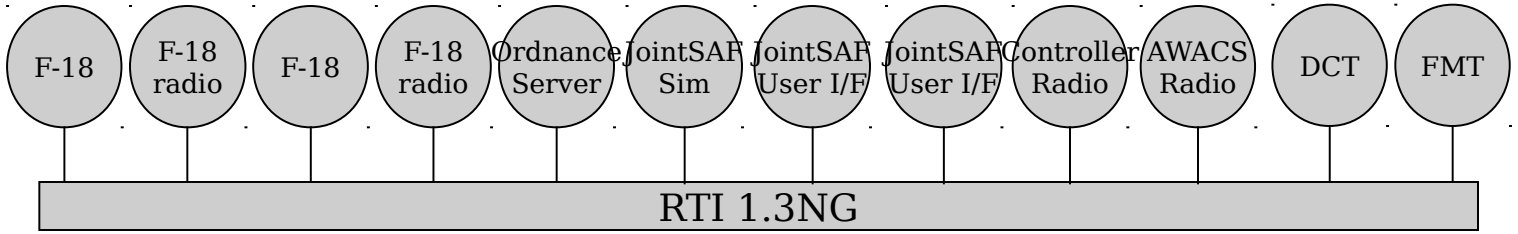
- **To meet the project objectives, we will form a team and follow the Federation Development and Execution Process (FEDEP)**
  - **as though we were building real-world training applications**
  - **with *training federation objectives* that will provide the experience and data required to support the *project objectives***
  - **a final report/ paper will address project objectives**
- **We will execute the FEDEP end-to-end,**
  - **including running prototype training events in the labs with surrogate training audiences, and producing relevant *training event* MOEs and MOPs**
  - **The demonstrations will present the federations and *project* lessons learned ; they will not be mock-training events**

Federation Development and Execution Process

Define Federation Objectives	Develop Federation Conceptual Model	Design and Develop Federation	Integrate and Test Federation	Execute Federation and Analyze Results
Identify Sponsor Needs Develop Objectives	Develop Scenario Perform Conceptual Analysis Develop Federation Requirements	Design Federation Develop Federation	Plan Execution Integrate Federation Test Federation	Execute Federation Analyze Results Prepare Feedback

The Federations





- **Taz-AF**
  - **2 AFRL F-16 simulators**
  - **AFRL controller station**
- **Taz-Nav**
  - **2 Navy F-18 simulat**
  - **an ordnance server**
- **Both federations:**
  - **ground and airborne threats represented in JointSAF**
  - **4 radio federates: 2 for simulators, 1 each for exercise controller and AWACS**
  - **DMSO Data Collection Tool and Federation Management Tool.**

Same training mission

Single execution of the FEDEP

Single FOM

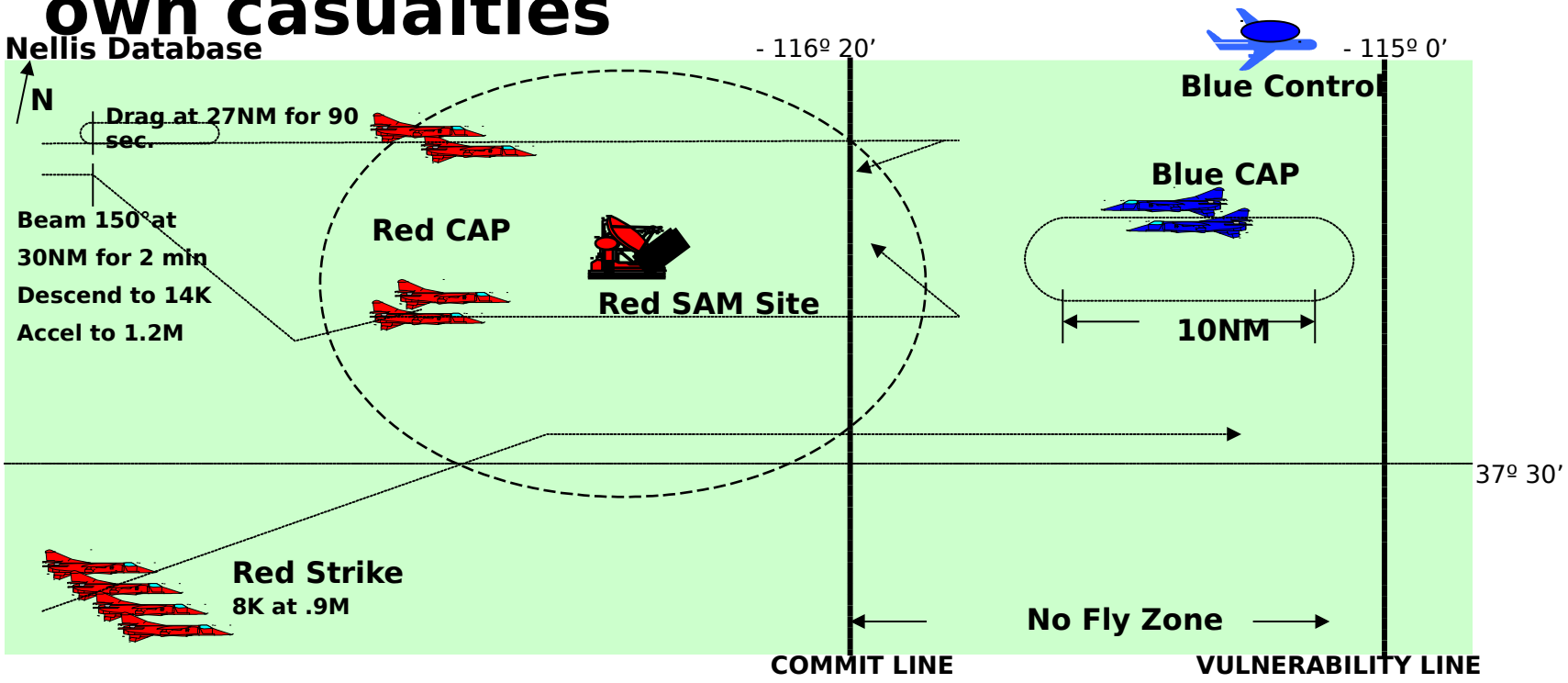
Notional Federation Purpose

The Tasmanian Devil (TAZ) federations will be designed as though to provide Air Force and Navy high fidelity, warfighter-in-the-loop, mission-level training for a very simple and specific set of air-to-air tasks.

The federations will be designed as though they were the starting point for a persistent and evolutionary federation capability that would support the full range of joint air combat missions and platforms.

Strawman Mission and Scenario

- **Protect friendly airspace against threat penetration while minimizing own casualties**



Training Objectives and Tasks

- **Objectives:**
  - **Develop proficiency in performing Defensive Counter Air (DCA) Procedures.**
- **Mission Tasks:**
  - **Maintain situational awareness.**
  - **Maintain radio discipline.**
  - **Perform CAP management.**
  - **Perform missile management.**
  - **Perform sensor management.**
  - **Perform threat suppression.**

Measures of Effectiveness

- **Mission level:**
  - **# threats that cross vulnerability line within vulnerability period**
  - **How well did pilot execute the plan**
- **Task Level:**
  - **Subjective proficiency ratings by evaluators**
  - **Specific computable measures**
    - **Total number of shots/hits/kills**
    - **% and number of shots valid at launch**
    - **Number of misses and reasons**
      - **Number of after-shot-off-gimbals**
      - **Number missiles defeated by threat countermeasures**
    - **Total number of radio steps (multiple keys)**
    - **# of observable broken pilot-to-pilot contract**
      - **# of radio contracts broken**
    - **# times data from AWACS wasn't used**
    - **# targets positively identified / possible target Ids**
    - **# times rules of engagement violated**

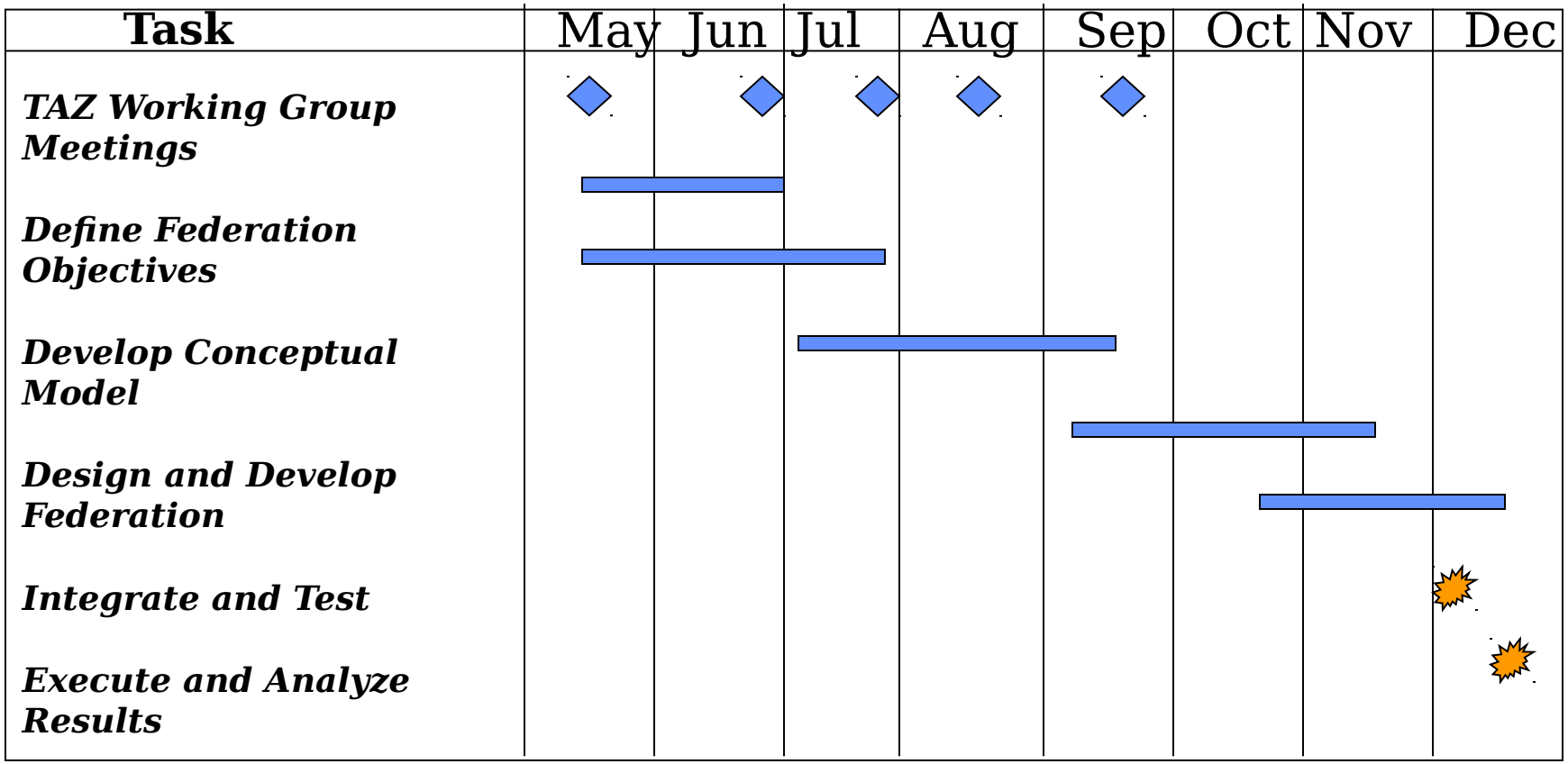
Federation Design Goals

- **Federations should support three types of requirements**
  - **Represent battle space**
  - **Generate data required to assess training value**
  - **Support automated technical federation operations**
- **Design decisions should not preclude evolution**
  - **sacrifice functionality before robust design**
- **No changes to the data provided and required by cockpits**

Taz Participants

- **Federate Developers:**
  - **AFRL/Raytheon: F-16, AFRL controller station**
  - **MFS: F-18, Ordnance server**
  - **DMSO/LMIS: JointSAF**
  - **DMSO: DCT, FVT, FMT**
  - **ASTi: Radio federate**
- **Surrogate Federation Users:**
  - **ACC, AFRL, MFS**
- **Systems Engineer:**
  - **DMSO CADRE (MITRE, SAIC, Lincoln Laboratory, VTC)**
- **Other team members:**
  - **ASC/YW, AFAMS**

TAZ Schedule



Taz-Nav demonstration

Taz-AF demonstration